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CAPRELLA SEPTENTRIONALIS KROYER (AMPHIPODA, CAPRELLIDAE) - AN INTERMEDIATE HOST OF NEMATODES OF THE GENUS CONTRACAECUM RAILLIET ET HENRY

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At the present time, many investigators (Polyanskii, 1955; Zhukov, 1960; Strelkov, 1960; Mozgovoi, Popova, 1965 and others) adhere to the opinion as to the low specificity of the nematode *Contracaecum aduncum* (Rudolphi, 1802) Baylis, 1920 in its selection of hosts. In studying the development cycle of *C. aduncum* we (Popova, Valter, 1965; Popova, Valter, 1967) have demonstrated the participation of some benthonic and planktonic invertebrates as the first intermediate hosts (*Antinoella sarsi* (Kinb.), *Eunoe nodosa* (Sars.), *Gattyana cirrosa* (Pall.), *Nereis pelagica* Linne, *Temora longicornis* (Müller), *Acartia longiremis* (Lilljeborg), *Pseudocalanus elongatus* Boeck].

Continuing the search for intermediate hosts of *C. aduncum*, we arrived at the skeleton shrimps *Caprella septentrionalis* Kroyer (Crustacea, Amphipoda), which are the favorite food of the cod (Izvekova, 1964), the navaga (personal observations) and other fish. M.V. Geptner (1963) mentions in a work on the biology of the White Sea skeleton shrimps the high degree of their invasion by parasites (up to 37%). The author notes that a combined infestation by nematodes and trematodes is usual for the skeleton shrimp, but does not identify the parasites. A.V. Ouspenskaja (1966, 1963), investigating the parasite

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(See Figure on preceding page)

Larva of Contracaecum sp. from the body cavity of Capella septentrionalis
A - General view (length 1.06 mm); 1 - anal aperture, 2 - larval tooth, 3 - oesophagus, 4 - nerve ring, 5 - excretory pore, 6 - intestinal caecum, 7 - ventricle, 8 - gastric caecum; 9 - intestine; B - front end; C - configuration of caudal end.

fauna of the mass invertebrates of the Barents Sea, established infestation of *C. septentrionalis* with metacercaria of *Genarches mülleri* and larvae of *Anisakis* sp.

The material was collected in Kandalaksha Bay in the White Sea (Velikaya Salma strait in the area of the White Sea biostation of Moscow University) in July-October 1966. A Sigsby trawl was used for collections. The crustaceans were fixed in 3% Formalin. Identification of shrimps was done after K. Stephensen (1942). Nematode larvae extracted from the crustaceans were placed in Barbagallo's liquid. A weak solution of glycerine in water or in lactic acid was used to study the nematodes. A solution of toluidine blue was used to develop the nerve ring and elements of the reproductive system.

In the study region, we found for the first time a rather high extensiveness of invasion (8.6%) of skeleton shrimp by nematode larvae of the genus *Contracaecum* (see Figure, *A*). The latter are very similar to the IIIrd stage larvae of *C.aduncum*, which we found (Popova, Valter, 1965) in polychaetes and fish. However, because of the fact that the affiliation of the larvae found to this species has not been confirmed experimentally, we denote them as *Contracaecum* sp. In Table 1, we list the data on the extensiveness of invasion

Table 1

Invasion of skeleton shrimp by larvae of Contracaecum sp. in 1966

1	2	3
[illegible] 4	[illegible]	13.5
[illegible] 5	[illegible]	14.0
[illegible] 6	[illegible]	1.9

Key: 1 - months; 2 - number of shrimps dissected; 3 - % invasion; 4 - July; 5 - August; 6 - October.

of the study shrimps in 1966 by month.

As can be seen in Table 1, invaded shrimps are found most often in the summer months, while invasion diminishes in October. It is interesting to note that we observed the same pattern in studying polychaetes in 1963 - 1965. Their invasion by *C. aduncum* larvae in the summer months proved to be much higher than in the fall. Skeleton shrimp of different age and sex were invaded by *Contracaecum* sp. to a different extent (Table 2). The females were much more strongly infested than the males. This may apparently be due to the fact that the females are more voracious than the males. The fry[1] was found to be completely free of larvae of the nematodes. It is likely that the adult individuals are always more active than the juveniles and consequently feed more intensively so that there is more opportunity to swallow *Contracaecum* larvae.

The intensity of invasion is 1-2 spec. *Contracaecum* larvae are localized

[1]We divided the crustaceans by age group on the basis of size. We assigned individuals less than 10-12 mm with underdeveloped secondary sexual characteristics to the group of young males or young females.

Table 2

Infestation of Caprella septentrionalis males and females by larvae of Contracaecum sp. in 1966

1	2				3			
	♂		♀		♂		♀	
	4	5	4	5	4	5	4	5
6	41	14.6	1	0	1	0		
7	133	24.1	31	11.6				
8	21	0.0	8.0	2.5	12	0	37	0

Key: 1 - months; 2 - adults; 3 - juveniles; 4 - number dissected; 5 - % infestation; 6 - July; 7 - August; 8 - October.

in the haemocoel. Through the transparent integuments of a shrimp which has just been caught, one can watch as a nematode larva "strolls" freely over the haemocoel, crawling from the anterior to the posterior segments of the crustacean. In fixed shrimp, the *Contracaecum* sp. larvae are situated at times in the head, at times extended along the intestinal tube, and at times in the posterior segments. Several times we found larvae which had partly or completely crawled into one of the marsupial plates of the female and had curled up there in several coils. These were often large larvae. Once a *Contracaecum* larva was found in gnathopod II of a small female *C. septentrionalis*. The front end of the larva stuck out freely in the body cavity, while the rest of the larva penetrated the musculature of the gnathopod and curved into the dactylopodite. Crawling into narrow orifices is very typical of the larvae of the nematodes. Such an unusual, at first glance, localization of the larva, appears to be a confirmation of this interesting fact.

Description of IIIrd stage larvae of *Contracaecum* sp. from shrimps. The larvae are of whitish-cream color, varying extremely in dimensions; the length

of larvae is from 1.069 to 14.947 mm; the maximal width is 0.065 - 0.439 mm. The body width in the area of the labria is 0.023 - 0.091 mm, in the area of the ventricle 0.050 - 4.439 mm, in the area of the anus 0.028 - 0.144 mm. The body is constricted towards the anterior and posterior ends; the posterior end is more acuminate and terminates in a spine 0.013 - 0.026 mm long and 0.004 - 0.006 mm wide.

The front end of the body is characterized by the presence of three labria and a larval tooth, which is situated more often laterally. Papillae appear on the labria in the larger larvae (see Figure, *B*). The cuticle of large specimens is lineolated at intervals of 0.0014 mm in the area of the anterior part of the body and 0.0021 in the middle part of the body. The esophagus is 0.265 - 1.843 mm long and 0.028 - 0.148 mm wide. The ventricle is 0.020 - 0.114 mm long and 0.023 - 0.122 mm wide, of irregular rectangular or trapezoidal shape. The gastric caecum is 0.180 - 0.893 mm long and 0.031 - 0.113 mm wide. As a rule, it is longer and wider than the intestinal caecum, whose length is 0.100 - 0.819 mm and width 0.026 - 0.113 mm. The nerve ring is situated at a distance of 0.134 - 0.502 mm from the anterior end of the body, the excretory pore at a distance of 0.176 - 0.294 mm from the anterior end (in larvae of length 1.478 - 6.491 mm). The distance of the anus to the tip of the tail is 0.085 - 0.346 mm.

For IIIrd stage *Contracaecum* larvae from skeleton shrimps, just as for *C. aduncum* larvae from polychaetes, according to our observations, the presence of a larval tooth and a tail extended into a sharp spine are typical. Through the transparent cuticle, one can examine the tail end, which has the most varied configuration and is often covered with tiny spinules (see Figure, *B*).

Larvae of length 5-6 mm can tentatively be divided by sex. Individuals having two contorted genital tubules, extending along the intestine, are

considered to be females. A vulva also appears in larger larvae. Thus, in a larva of length 14.947 mm, the vulva is quite distinct, although its opening is still concealed, being situated at a distance of 6.566 mm from the anterior end of the body. The somewhat curved vagina has a length of 0.432 mm and a width of 0.026 mm and continues into a short, slightly broadened uterus, which soon becomes two branches, which represent the future oviducts. Thus we see as if in miniature the reproductive system of the adult female. The male is characterized by a single genital tubule. We were not able to find any other characteristics (spicules, genital papillae).

Having analyzed by the characters indicated all *Contracaecum* sp. larvae from skeleton shrimps, we established that females are found more often.

Our investigations of *Contracaecum* sp. larvae showed that a gradual increase in the linear dimensions of the body and organs of the parasite takes place in the organism of the host - the skeleton shrimp and that various formations (papillae on the labria, genital tubes) appear. There is a gradual restructuring of the organization of the entire larva which in this case can occur only in an intermediate host. This gives us grounds to consider the skeleton shrimp as one of the intermediate hosts of the nematodes of the genus *Contracaecum*.

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Summary

In the region of the Kandalaksha Bay of the White Sea (Velikaya Salma Strait) a high spontaneous infection of amphipods Caprella septentrionalis with the larvae of nematodes Contracaecum sp. was first registered, these latter being localized in the body cavity of amphipods The females of C. septentrionalis are infected with the larvae of Contracaecum sp. much stronger than the males are. A study of morphological alterations of Contracaecum sp. in the organism of amphipods allows to consider these latter to be intermediate hosts of the parasite.